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Discovery of time - From abstract concept to computer-generated visualization

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Discovery of Time -
From abstract concept to computer-generated visualization

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[Introduction]

Problem Statement:

Time, itself, is a virtual world. We measure it biologically and mechanically. We talk about "general relativity" because we all have different interpretations about time. Language consists of the syntax (form), semantics (meaning), and pragmatics (function). Time is the best example for those definitions. Time can be vivid, complex and profound. When we close our eyes, do we try to image what time looks like? How many possibilities it could be? How could we expand our imagination of this abstract idea?

Objective:

Time has so many aspects and meanings. My idea is to try to find out how to represent this formless concept into a concrete shape. Using computer software to create an interactive environment of time (game), users will be able to explore the imaginative aspects of time. To visualize the abstract concept will be my goal and challenge.

This interactive environment will consist of animation, sound, and video. The environment will be set up as three different time spaces (games) so that users can travel within these spaces and play with them.

Target Audience:

Gender	Male - Female
Age	15 – 50
Occupation	Any occupation
Education Level	High School - College
Computer Experience	Intermediate

[Review of Literature]

Time is one kind of broad, deep thought in the universe. The biggest problem I encountered was researching the information. There are endless books, articles, and other writings about time. Time deals with not only the narrative context but also the mathematic and physical theories, which are very hard for me to understand in a very short time. Due to these reasons, I decided to choose some of them to determine my thesis direction. It will help me to construct my whole framework more precisely as well.

The literature includes three parts: science fiction, art, and physical theory.

1. Science fiction:

I adopted one of the concepts from "Einstein's Dreams", which is a novel about all kinds of time ideas. The one I used is called "Time has Three Dimensions".

(19 April 1905)

Time has three dimensions; each act has three possible outcomes.

Time has three dimensions, like space. Just as an object may move in three perpendicular directions, corresponding to horizontal, vertical, and longitudinal, so an object may participate in three perpendicular futures. Each future moves in a different direction of time. Each future is real, each with the same people but with different fates for those people. The world splits into three worlds, each with the same people but different fates for those people. In time, there are an infinity of worlds.

2.Art:

"Art & Physics" is a book combining art and physical theories. It uses artwork and illustrations to explain the "Special Relative Theory" from Einstein. I am focusing on the "Constancy of the Speed of Light" section. Only the speed of light is constant, at 186,000 miles per second.

When we "see what time it is " we are really seeing the state of the face of the clock a moment before. Light always carries within it the frozen moment of an image's creation. Time depends entirely upon the speed of the observer relative to the position of a clock (or, conversely, the speed of the clock relative to the observer.)

This peculiarity of the nature of time has the additional effect of seeming to bring the past and the future closer together when traveling at ever increasing speeds. Finally, the present incorporates all the past, and more of the future, so that all time exists in one still moment of now. At light speed, time ceases to change because it contains all change.

The other bizarre optical effect of the relativistic viewpoint is the simultaneous appreciation of more that one side of an object when seen from the windows of the train. In our everyday world, to view the sides of an object after seeing it from the front, time must elapse and our position must change in space. From the high-speed train, however, the front and the side of an object can be seen simultaneously.

As the train continues to accelerate, space becomes even more contracted until finally, at the speed of light, space along the train axis of direction contracts into an infinitely thin plane having height and depth but no length. Things look "scrunched up". Space between objects is truncated, and figures begin to look two-dimensional, less rounded, and take on the appearance of flat playing cards.

3.Physical Theory:

Einstein, in 1905, through a set of equations that expressed the transformation law for light frequencies, merged the classical Doppler effect with his special theory and in so doing explained the exact nature of relativistic color changes.

The radiation emitted by an object moving toward an observer is squeezed; its frequency appears to increase and is therefore said to be blueshifted. In contrast, the radiation emitted by an object moving away is stretched or redshifted. It also indicates their motions with respect to the observer.

[Process]

To sum up, my thesis consists of three elements, which are "The Constancy of the Speed of Light", "Time has Three Dimensions" and "Doppler Effect". I will use these ideas to build my games.

Design Considerations:

1. Representation:

I want to use these concepts to visualize what time looks like under these elements. However, these concepts are not easily understood by the public, or myself. Knowing this, the best way to demonstrate and help my audience understand these ideas is by making **games**. Through the interactive exploring environment, the users could experience the visualization of time for themselves.

2. Navigation Structure:

Basically, each game represents one time concept I mentioned. In other words, each time is a "world". Three games means I create three different worlds of time. I'd like to use the "parallel world", (see glossary in Appendix), to illustrate how to travel from one game to another. The main menu always stays on the left side of the stage.

The users could choose any of three games from the main menu. It is not only easy to navigate from one to another, but also the users always know where are they.

3. Design Concept:

The range of my target audience is quite wide. The game should be suitably designed for each age level. The tone of the games will be vivid and colorful, but still have a 'time and space' feeling to them. The background environment (graphics) will be three-dimensional so that it matches the 'time and space' atmosphere. The font will be more technical and space-like. The color scheme will be blue, pink, and purple. The blue represent a "cold" color scheme. It provides a more rational, technical and professional feeling. I feel the pink and purple are perfect colors to convey a feeling of space.

Technical issues:

Game1- [Time Sequencer]—concept: Time has three dimensions

In this game (world), time has three dimensions, the same people with different fates. Each future is real. I made 2 events and then decomposed them into a few segments. In this world, the start and the ending parts are fixed for the character. The things that the user can change fall between the starting and ending points. The users can rearrange the order of the event. The users can see the difference when they made different choices.

I chose animated QuickTime movies due to the age range of my audience and the popularity of animation, compared to drama. In this game, two concepts represent the different meanings of time. The first concept is the rearrangement of the time order. The second concept is about linear time.

Game2- [Time Crosser]—concept: Simulate real life

In this game (world), I tried to simulate a real life situation of how "time" influences our relationship with other people. How long does it take to meet our Mr. or Miss Right? How do we interact with friends and strangers? I used Director Lingo to create this scenario so users can manipulate the situation in this game.

Game3- [Time Ripper]—concept: Doppler effect

In this game (world), the color and the sound will change according to the distance of sound waves moving toward the observer. Again I used Director Lingo to create the sound waves and incorporate the sound and the color together.

Troubleshooting:

I encountered lots of problems when I made these games. I used Director Lingo to write all the code. My games are built in programming except the background graphics and a few animation loops.

In game 1, the difficulty is how to play a movie list, trigger the next movie to play (see coding example in Appendix) and replace the movie from the movie list (see coding example in Appendix). The solution is to set a movie list first and then create a variable whose function is to detect the last frames of the playing movie. As soon as the frames passed by this variable, it will play the next movie of the movie list.

Game 2 and game 3, had some relatively easy problems to fix. Examples of these are how to reset the game to the original state in game 2 and how to set the color shift from red to blue when the circle of sound wave moves, and vice versa (see coding example in Appendix).

Regarding the navigation function, all of my games and the main menu are connected by the window command in Director. In other words, when you open another window of a game, the programming will close the one opened automatically. Two of my games have more than one window to be closed. This will cause a problem. The way to solve it is to set another variable for the game which has to close two windows (see coding example in Appendix).

[Summary]:

In addition to the three games, I also made the opening and introduction pages so that the users know how to play the games. When I did the usability testing, I found a few things which could be revised for the users.

1. The users were confused how to see my intros of the three games because the intro text was designed to move right or left depending on the mouse direction. In the beginning, the text is invisible, unless the user rolls over the graphic. Sometimes the text was already off the stage, but the users didn't realize it. I redesigned the text so it still moves around, but would not go off the stage.

2. In the main menu, the click buttons are the four balls which represent the three games and the credit page. I made the flying text for the three games and the credit page for visual effect. As long as the user rolls over the ball, the flying text will shift the position to that ball. However, for the first time user, they always rollover the flying text instead.

3. In game 3, the intro text font is a little bit hard to read. I changed to another font which solved the problem.

Because of this user feedback, the readability, visibility, and audibility of my thesis was greatly improved.

[Conclusion]:

I think the main reason that I choose "time'' as my thesis concept is because it is genuinely interesting to me. We talk about time all the time. We can measure time. We can feel time pass by us. We just can't see "time". People rarely try to visualize time because it is too abstract. Since "time" is so important and exerts such a tremendous influence on our daily life, it is worthwhile trying to visualize. I still remember how hard it was for me to understand physics when I took it in undergraduate school. If this tedious

subject could be more vivid, attractive, and understandable, it might change the learning attitude about this kind of subject. This is the main purpose for my thesis.
Through my thesis, I become more proficient in utilizing QuickTime movies in Director. Director has its own limitations on QuickTime movies. For instance, if you want to change the property of the movie sprite, you have to turn on the "Direct to stage" function. I encountered lots of problems making my game 1 work (see the process section). In my thesis, I tried to incorporate and control two movie lists on the same sprite. That caused some pain for me. I didn't see anybody do this before because they usually use graphic looping as a movie. It has a smaller file size and is easier to view on the Internet. The real QuickTime movie still has a big file size and the viewing difficulty. In my opinion, the QuickTime movie function is one of the most powerful in Director, especially since it can be applied to the video and audio separately. It probably is not the mainstream in Director, but technology is changing everyday and I believe QuickTime will get its respect from the public.

[Appendix]

(Glossary):

1. Special relative theory: Einstein's Special Theory of Relativity describes the motion of particles moving at close to the speed of light. Einstein's theory of special relativity results from two statements -- the two basic postulates of special relativity. 1. The speed of light is the same for all observers, no matter what their relative speeds. 2. The laws of physics are the same in any inertial (that is, non-accelerated) frame of reference.

2. Parallel worlds: In 1957, Hugh Everett III proposed a radical new way of dealing with some of the more perplexing aspects of quantum mechanics. It became known as the Many-Worlds Interpretation.

   According to this interpretation, whenever numerous viable possibilities exist, the world splits into many worlds, one world for each different

possibility (in this context, the term "worlds" refers to what most people call "universes"). In each of these worlds, everything is identical, except for that one different choice; from that point on, they develop independently, and no communication is possible between them, so the people living in those worlds (and splitting along with them) may have no idea that this is going on.

(Coding examples)

1. How to play a movie list and trigger the next movie to play:

```
on startmovie
mylist = ["sleep", "sleep", "sleep", "sleep", "sleep", "work"]
end

on plays me
  inpoint = member(mylist[counter]).duration - 4 -- set the passing point of
                    each movie(minus 4 cause it easy to pass the duration).
if sprite(moviesprite).movietime >= inpoint then
  counter = counter + 1-- trigger to play the next movie of the list
  sprite(moviesprite).movietime = 0
if counter > mylist.count then
    counter = 1
    sprite(moviesprite).member = mylist[counter]
  end if
end if
sprite(moviesprite).member = mylist[counter]

mymovietime = 0 -- initialize the passing time of the movies
currentime = 0 -- initialize the current movie time

-- If we play the first movie, it's impossible to have any margin there cause
   that's the starting point, so we set up the counter start from 2 and it
   will calculate the sum of movielength before the playing one. That's why
   counter - 1.

  if counter > 1 then
  repeat with i = 1 to counter -1
    mymovietime = mymovietime + member(mylist[i]).duration
  end repeat
  end if
  end
```

2. How to replace the movie in the movie list:

```
on testLoc me

  set testH = sprite(spritenum).loch
  set testV = sprite(spritenum).locv

  if abs(pTargetH - testH) < pVariance then
    if abs(pTargetV - testV) < pVariance then
      sprite(spritenum).loc = pTargetLoc
      mylist[2] = clipname && "clip"
      sprite(spritenum).moveablesprite = FALSE
      sprite(moviesprite).member = mylist[2]
      sprite(moviesprite).plays()
      sprite(whichclip+9).loc = originloc
      sprite(moviesprite).movierate = 1
    else
      sprite(spritenum).loc = originloc
    end if
updateStage
end
```

3. How to close multiple windows:

```
global windowOpen

property mywindow

on mouseup me
    if windowOpen <> empty then
      forget window windowOpen
      forget window "text"
      end if
      window(mywindow).windowtype = 2
      open window mywindow
      windowOpen = mywindow
   end
```

4. How to shift the color from red to blue in game 3:

```
on exitframe me

  count = 1 + count mod(numRings)
  newObjectLocation

  repeat with i = 1 to 6
    sprite(i+ 49).visible = 100
  end repeat
```

```
if objectSpeed > 0 then-- right direction
  sprite(53).color = rgb( 0, 0, sprite(20).loch/2)--blue shifting
  sprite(50).color = rgb(sprite(20).loch/2, 0, 0)--red shifting
  note = (sprite(20).loch/10) -10
  myChannel = myChannel + 1
  if myChannel > 8 then
    myChannel = 1
  end if
  sound(myChannel).queue( [#member:member("piano"),#startTime: 1000,#endTime:
                           3000, #rateShift: random(note)] )
  sound(myChannel).volume = 100
  sound(myChannel).play()
  else if objectSpeed< 0 then -- left direction
  sprite(53).color = rgb(255-sprite(20).loch/2, 0, 0)--blue shifting
  sprite(50).color = rgb( 0, 0, 255-sprite(20).loch/2)--red shifting

  note =(sprite(20).loch/10)-10
  myChannel = myChannel + 1
  if myChannel > 3 then
  myChannel = 1
  end if
  end
```


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(URL resource)

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2. http:// www.english.uwosh.edu/einstein/synopsis.html
3. http:// www.english.uwosh.edu/einstein/narrative.html
4. http:// plato.Stanford.edu/entries/thought-experiment/
5. http:// oposite.stsci.edu/pubinfo/PR/1999/18/index.html
6. http://www2.slac.stanford.edu/vvc/theory/relativity.html
7. http://www.station1.net/DouglasJones/many.htm
8. http://www.fjallfil.com

(Animation clip):

1. “Life is a Film” from "Guido Manuli: Animator"
2. “Incubus” from "Guido Manuli: Animator"

(Music):

1. “A final hit” from "Trainspotting"
2. “Fohlenfur” from "Pole3"
3. “Green velvet it is not over yet” from "a. states"
4. Sound clips from Internet.

(Software):

Macromedia	Director
Image	Photoshop/ Illustrator / Premiere
Music	SoundEdit
Compressor	Media Cleaner

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